

Claims:

1. A multi-layer film comprising microfibers.

5 2. The film of claim 1 wherein the film is uni-axially oriented by stretching in one direction relatively more than stretching in a perpendicular direction.

10 3. The film of claim 1 comprising two opposing surfaces, each surface comprising microfibers.

4. The film of claim 3 wherein one surface is hydrophilic and one surface is hydrophobic.

15 5. The film of claim 1 comprising two opposing surfaces, one surface comprising microfibers and the other surface not comprising microfibers.

20 6. The film of claim 5 wherein a film layer having the surface not comprising microfibers exhibits a property selected from the group consisting of: elasticity, high or low modulus, puncture resistance, tear resistance, breathability, flame retardancy, high temperature resistance, low temperature resistance, and combinations thereof.

25 7. The film of claim 1 comprising a microfiber layer and a non-microfiber layer, the microfiber layer comprising a material that exhibits a property selected from the group consisting of hydrophobicity, hydrophilicity, oleophobicity, oleophilicity, a dielectric property, low coefficient of friction, stain resistance, flame retardance, high strength or modulus, an ability to produce a certain size microfiber, and combinations thereof, and

30 the non-microfiber layer comprising a material selected from the group consisting of a hydrophobic material, a hydrophilic material, an elastomeric material, a tear resistant material, a puncture resistant material, a high or low temperature resistant material, high strength, high modulus, adhesive properties, and a flame retardant material.

8. The film of claim 7 wherein the microfiber layer comprises a polypropylene.

9. The film of claim 7 wherein the non-microfiber layer comprises an elastomeric polymer.

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10. The film of claim 1 wherein the multi-layer film is selected from the group consisting of:

a film consisting of two layers and a film consisting of three layers.

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11. The film of claim 1 wherein the film comprises a non-microfiber layer comprising a material selected from the group consisting of a polypropylene, a polyethylene, a styrene-ethylene/butylene-styrene block copolymer, a styrene-isoprene-styrene block copolymer, a polyurethane, a fluoropolymer, poly(butylene), poly(isoprene), a nylon, and an adhesive.

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12. The film of claim 1 wherein the film comprises two microfiber layers sandwiching a non-microfiber layer.

13. The film of claim 12 wherein the non-microfiber layer is elastomeric.

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14. The film of claim 12 wherein the non-microfiber layer comprises a material selected from the group consisting of a polypropylene, a polyethylene, a styrene-ethylene/butylene-styrene block copolymer, a styrene-isoprene-styrene block copolymer, a polyurethane, a fluoropolymer, poly(butylene), poly(isoprene), a nylon, and an adhesive.

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15. The film of claim 12 wherein a microfiber layer is a semicrystalline polymer selected from the group consisting of high and low density polyethylene, polypropylene, polyoxymethylene, poly(vinylidene fluoride), poly(methyl pentene), poly(ethylene-chlorotrifluoroethylene), poly(vinyl fluoride), poly(ethylene oxide), poly(ethylene terephthalate), polyethylene naphthalate, poly(butylene terephthalate), poly(lactic acid), nylon 6 12, nylon 6, nylon 66, polybutene, a thermotropic liquid crystal polymer, a blend of one or more of these polymers, or a copolymer of one or more the named monomers.

16. The film of claim 1 wherein the film is co-extruded.

17. The film of claim 1 wherein the film comprises from about 2 to about 5 layers.

5 18. The film of claim 1 wherein the film comprises from about 2 to about 5 layers, and the total film thickness prior to fibrillation is in the range from about 25 to about 10,160 microns.

10 19. The film of claim 1 consisting of a microfiber layer and a non-microfiber layer.

20. The film of claim 1 consisting of 2 microfiber layers.

15 21. The film of claim 1 consisting of 3 layers: one non-microfiber layer sandwiched by two microfiber layers.

22. The film of claim 1 wherein the microfibers have an average effective diameter of less than 20 microns and a transverse aspect ratio of from 1.5:1 to 20:1.

20 23. The film of claim 1 wherein the microfibers have an average effective diameter of less than 5 microns.

24. The film of claim 1 wherein the microfibers have an average cross-sectional area of $0.7 \mu^2$ to $2.1 \mu^2$.

25 25. A multi-layer microfiber article comprising at least one microfiber layer and a non-microfiber layer comprising a material selected from the group consisting of a polypropylene, a polyethylene, a styrene-ethylene/butylene-styrene block copolymer, a styrene-isoprene-styrene block copolymer, a polyurethane, a fluoropolymer, poly(butylene), poly(isoprene), a nylon, and an adhesive.

30 26. The article of claim 25 wherein the non-microfiber layer is elastomeric.

27. The article of claim 25 wherein the non-microfiber layer exhibits a property selected from the group consisting of: elasticity, high or low modulus, puncture resistance, breathability, flame retardancy, temperature resistance, and combinations thereof.

5 28. The film of claim 25 wherein the microfiber layer comprises polypropylene.

29. A co-extruded, oriented, multi-layer film comprising one or more microfiber-forming layers.

10 30. The film of claim 29 consisting of two layers.

31. The film of claim 29 consisting of two microfiber-forming layers.

32. The film of claim 29 consisting of three layers.

33. The film of claim 29 comprising a non-microfiber-forming layer sandwiched between two microfiber-forming layers.

34. The film of claim 33 wherein one microfiber layer can be microfibrillated to a hydrophilic surface, and one microfiber layer can be microfibrillated to a hydrophobic surface.

35. A two-layer co-extruded film comprising one or two microfiber-forming layers.

25 36. A multi-layer microfiber article comprising a first microfiber layer at a surface of the article, and second microfiber layer adjacent to the first microfiber-layer, wherein areas of the surface are microfibrillated to form microfibers of only the first layer, and areas of the surface are microfibrillated through the first layer to form microfibers of the second layer.

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37. The multi-layer microfiber article of claim 36 wherein a surface of the article includes a pattern comprising a first area of microfibers of one layer of the article, and a second area of microfibers of the second layer.

38. The article of claim 37 wherein an area of microfibers has a property selected from the group consisting of: hydrophobicity, hydrophilicity, oleophilicity, and oleophobicity.

39. A method of producing a microfiber-forming multi-layer film, the method comprising

providing an oriented film,

casting a polymeric film onto the oriented film to produce a multi-layer film,

orienting the multi-layer film to produce a multi-layer film having one or more layers that can be microfibrillated to produce microfibers.

40. A method of producing a microfiber article, the method comprising:

providing a multi-layer film comprising at least one microfiber-forming layer, and

microfibrillating the microfiber-forming layer to form microfibers.

41. The method of claim 40 wherein the film is uniaxially-oriented.

42. The method of claim 40 wherein the film is co-extruded.

43. A method of producing a microfibrillated article, the method comprising

co-extruding a multi-layer film,

orienting the film,

and microfibrillating the layer to form microfibers from the layer.

44. A method of producing a microfibrillated article, the method comprising

providing an oriented film,

casting a polymeric film onto the oriented film to produce a multi-layer film,

orienting the multi-layer film to produce a multi-layer film having one or more layers that can be microfibrillated to produce microfibers,

and microfibrillating the layer to form microfibers from the layer.